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Swine Feed Efficiency: Influence of Temperature

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Abstract
Pig performance, including feed efficiency, is maximized when animals are kept within their thermoneutral zone. When describing the environmental conditions that the animal is raised in, it is important to realize that there are several factors influencing pig comfort. "Effective" environmental temperature is a better measure than "air" temperature, as it takes into account relative humidity, air movement (velocity), flooring type and condition, insulation of the building, evaporative cooling, and huddling of pigs. Pigs of different size and age have different thermoneutral comfort zones, as younger, smaller pigs have higher temperature requirements and have a smaller tolerance for temperature changes (Figure 1). As pigs grow, their thermoneutral zone expands and they are able to tolerate a much wider range of temperature before growth rate and feed efficiency are affected.

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Introduction

Pig performance, including feed efficiency, is maximized when animals are kept within their thermoneutral zone. When describing the environmental conditions that the animal is raised in, it is important to realize that there are several factors influencing pig comfort. "Effective" environmental temperature is a better measure than "air" temperature, as it takes into account relative humidity, air movement (velocity), flooring type and condition, insulation of the building, evaporative cooling, and huddling of pigs. Pigs of different size and age have different thermoneutral comfort zones, as younger, smaller pigs have higher temperature requirements and have a smaller tolerance for temperature changes (Figure 1). As pigs grow, their thermoneutral zone expands and they are able to tolerate a much wider range of temperature before growth rate and feed efficiency are affected.

Effects of Environmental Temperature on Performance

Pigs are homoeothermic animals maintaining body temperature within narrow limits under varying environmental conditions, balancing heat loss and heat production. When temperatures fall below the pig's lower critical limit, the pig must produce additional heat; they may do so by increasing energy intake or diverting more energy from growth to maintenance, or a combination of the two. In finishing pigs fed a balanced diet, feed efficiency mostly depends on the level of energy intake, maintenance requirement, and the efficiency with which ME above maintenance is used for growth. Changing feed (energy) intake is one way the animal is able to cope with changes in temperature. During times of cold stress, a pig will increase feed intake. During times of heat stress, feed intake is reduced.

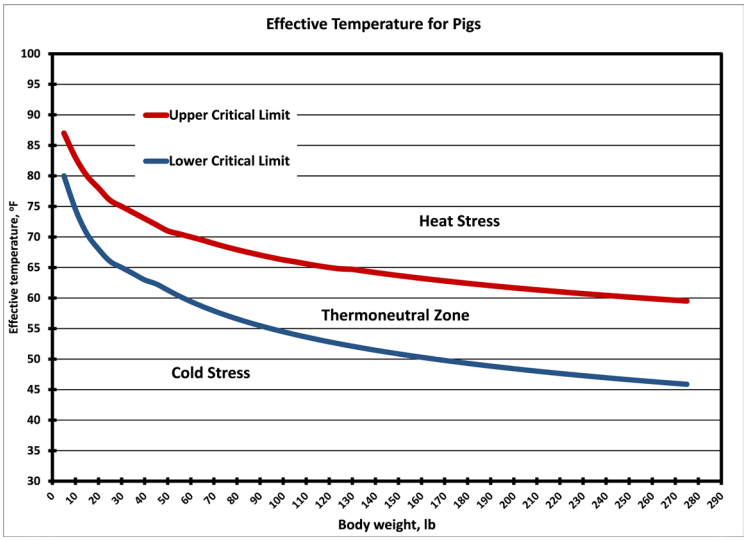

Figure 1. A model illustrating effective temperatures for pigs of different weights.

The effects of temperature outside of grow-finish pigs' thermoneutral temperature zone are shown in Table 1. Pigs consume more feed and are less efficient at converting feed to gain when the effective temperature is below their lower critical limit as more nutrients are used for maintenance and less are available for growth. When temperatures are above the upper critical limit, pigs are less active and consume less feed; however, their maintenance requirements may still be relatively high due to increased respiration rate. Respiration rates increase dramatically during heat stress because pigs lack the ability to sweat and, therefore, panting is a means to remove body heat. Additionally, the animal's average daily feed intake is lower which slows average daily gain resulting in more days to market and impacting feed efficiency.

Table 1. Effect of environmental temperature on the performance of growing pigs (50 to 125 pounds)[1]

	Temperature, °F		
Item	**50**	**72.5**	**95**
ADG, lb	1.70	1.76	1.41
ADFI, lb	4.86	4.21	3.52
Feed/gain	2.91	2.41	2.52

[1]Summary of 3 experiments; Stahly and Cromwell, 1979, 1981.

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Temparture and Feed Intake

Table 2 shows the increased feed intake of different sized pigs for each degree Fahrenheit below their lower critical temperature (LCT). Example: A finisher pig weighing 220 lb which is kept 10 °F cooler than its LCT would be expected to eat 0.43 lb more feed per day than a pig housed at the correct temperature. In a 2,400 head finishing barn, daily consumption of feed would be increased by over 1000 lb/day or 3.5 tons per week.

Table 2. Increase in feed intake when the effective environmental temperature falls below the pigs' lower critical temperature (LCT)

Category	Weight, lb	Increase in Feed Intake, lb/d
Piglet	4	0.005
Nursery	20	0.008
Nursery	45	0.016
Grower	100	0.026
Finisher	220	0.043
Thin Sow	313	0.073
Heavier Sow	>450	0.042

*Based on a diet ME of 2900 kcal/kg or 1315 kcal/lb. Data adapted from Holmes and Close, 1977

Additional Key Considerations

- Manipulating the amount of fiber in the diet can be used as a management tool whether in a hot or cold envi ronment as heat generation is greater with increasing dietary fiber.
- Reducing crude protein or increasing diet energy through fat addition can improve performance during heat stress.
- Ventilation management is vital to providing the correct air conditions, preventing cold, damp or hot, humid environmental conditions.
- Evaporative cooling (drippers, misters, or foggers) is an effective tool to reduce thermal stress and the effective environmental temperature felt by the pig during hot weather.
- Genetic lines with lower residual feed intake may have an improved ability to cope with heat stress.

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